FIG. 1

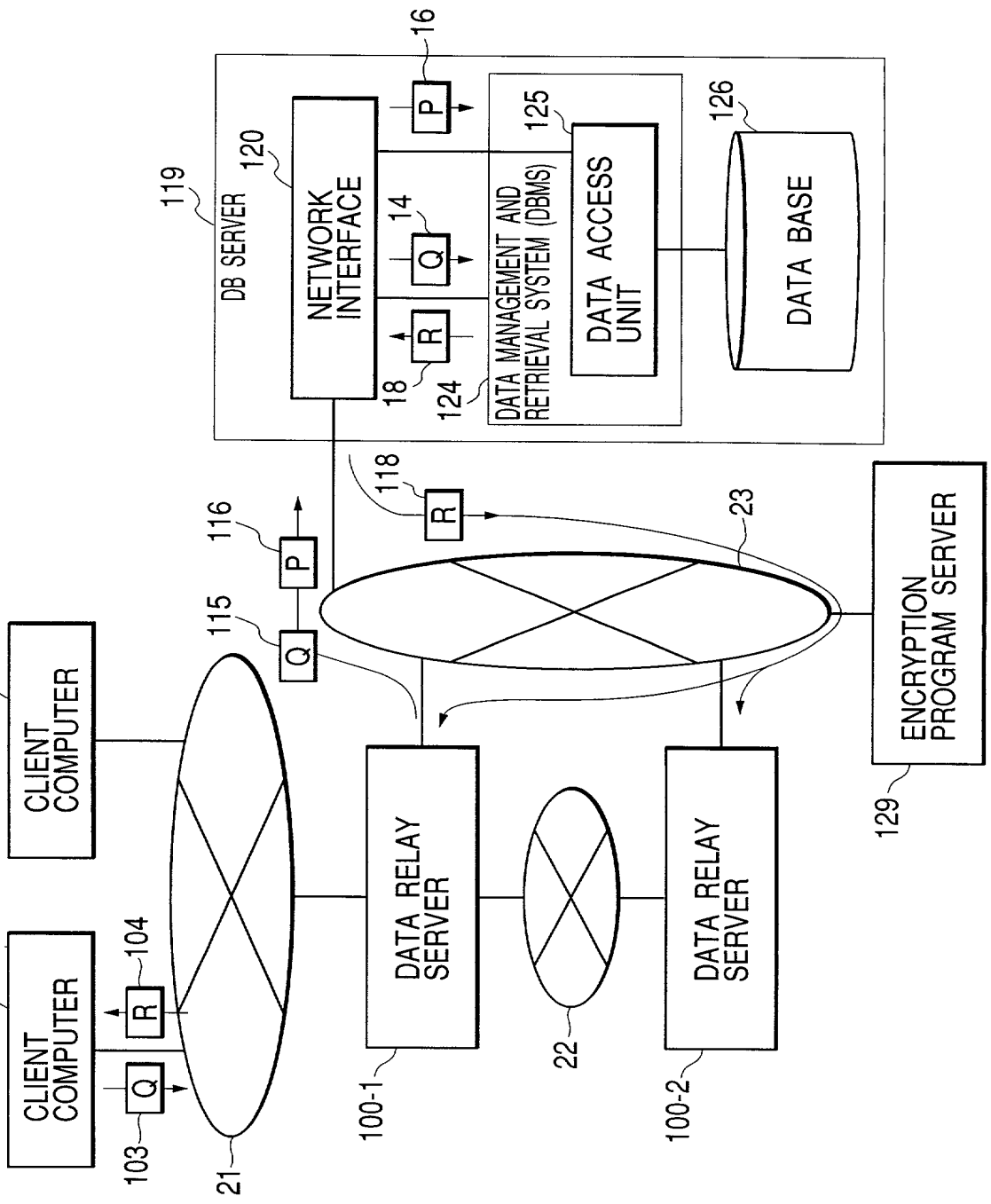
CLIENT COMPUTER
10A
CLIENT COMPUTER
10B
R
104
Q
103
21
DATA RELAY SERVER
100-1
22
DATA RELAY SERVER
100-2
Q
115
P
116
R
118
23
ENCRYPTION PROGRAM SERVER
129
DB SERVER
119
NETWORK INTERFACE
120
P
16
Q
14
R
18
124
DATA MANAGEMENT AND RETRIEVAL SYSTEM (DBMS)
DATA ACCESS UNIT
125
DATA BASE
126

FIG. 2

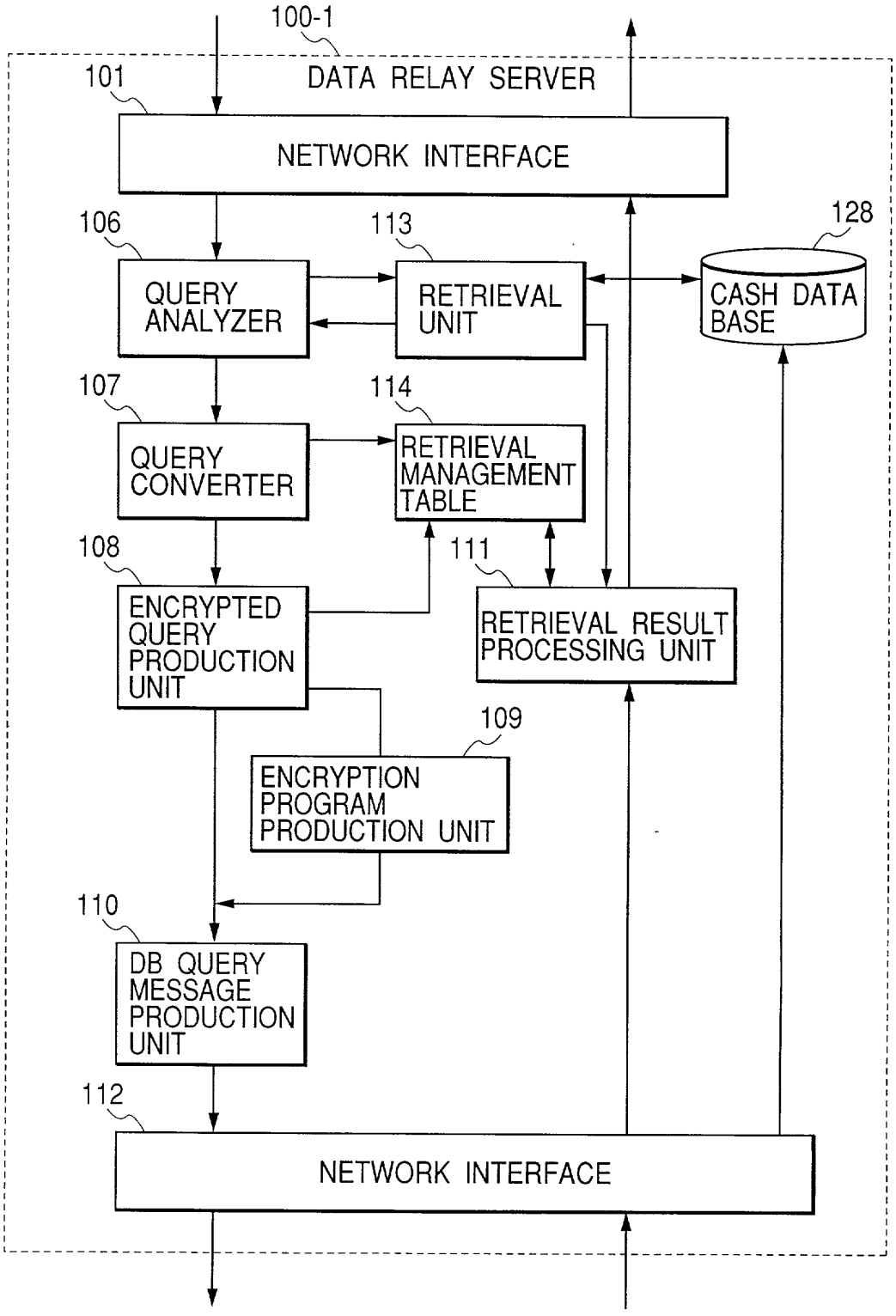
100-1
DATA RELAY SERVER
101
NETWORK INTERFACE
106
QUERY ANALYZER
113
RETRIEVAL UNIT
128
CASH DATA BASE
107
QUERY CONVERTER
114
RETRIEVAL MANAGEMENT TABLE
108
ENCRYPTED QUERY PRODUCTION UNIT
111
RETRIEVAL RESULT PROCESSING UNIT
109
ENCRYPTION PROGRAM PRODUCTION UNIT
110
DB QUERY MESSAGE PRODUCTION UNIT
112
NETWORK INTERFACE

FIG. 3

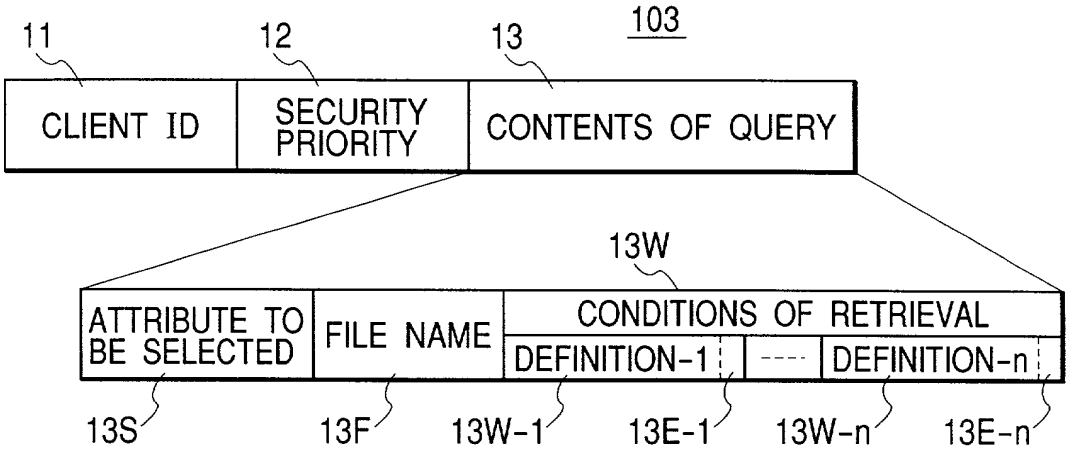

FIG. 4

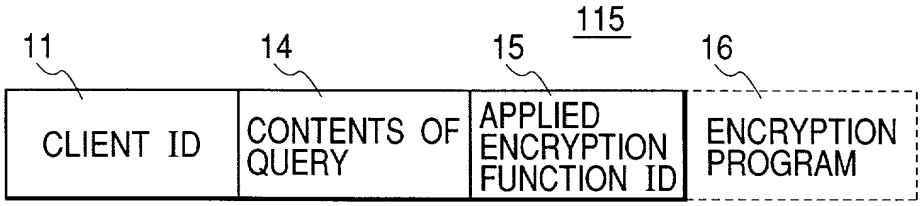

FIG. 5

114 RETRIEVAL MANAGEMENT TABLE

1141 CLIENT ID	1142 CONTENTS OF ORIGINAL QUERY	1143 CONTENTS OF CONVERTED QUERY	1144 TYPE OF CONVERSION	1145 1:1 CONVERSION FLAG	
					EN-1
					EN-2

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FIG. 6

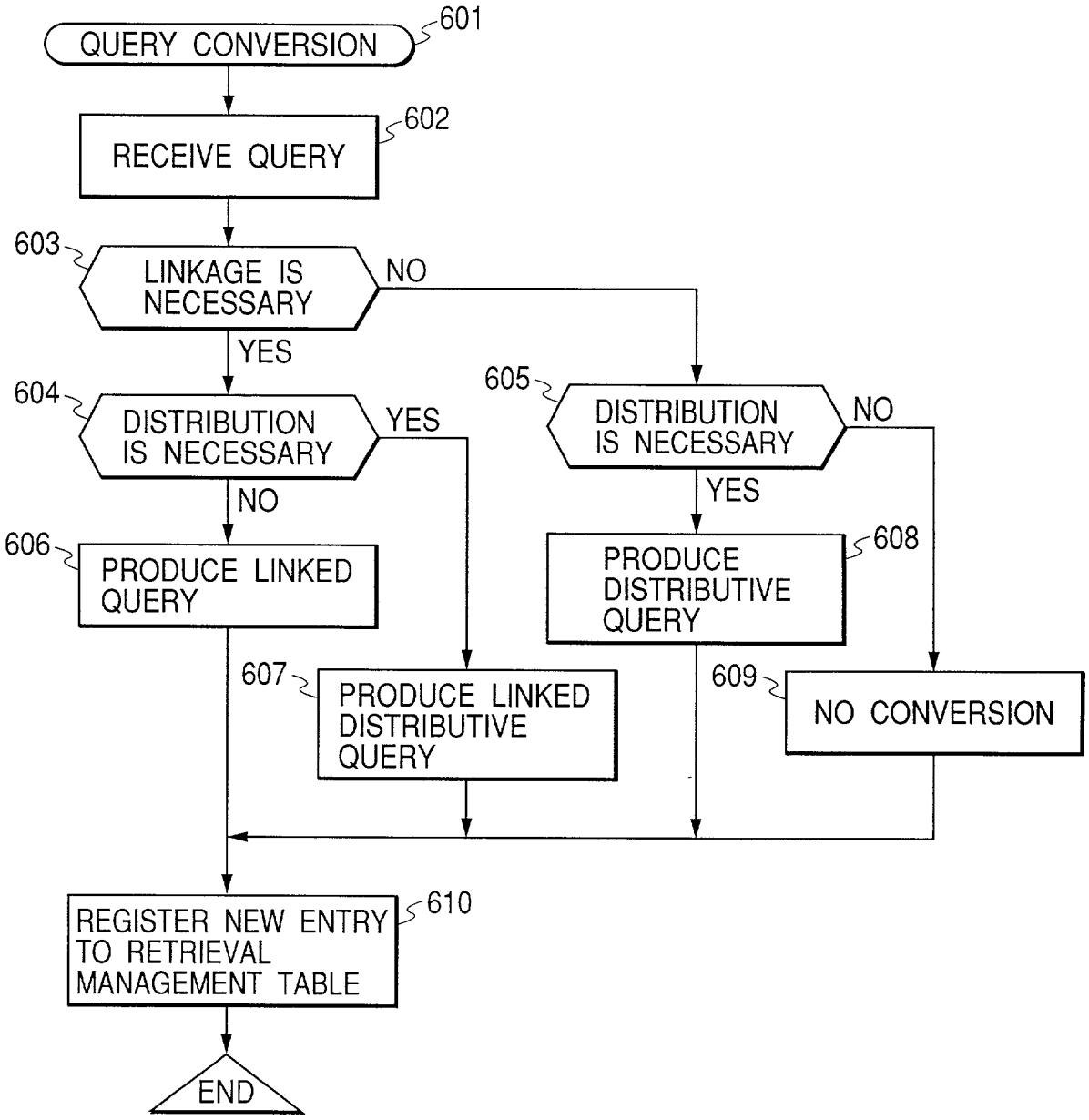

QUERY CONVERSION
601
RECEIVE QUERY
602
603
LINKAGE IS NECESSARY
NO
YES
604
DISTRIBUTION IS NECESSARY
YES
NO
605
DISTRIBUTION IS NECESSARY
NO
YES
606
PRODUCE LINKED QUERY
608
PRODUCE DISTRIBUTIVE QUERY
607
PRODUCE LINKED DISTRIBUTIVE QUERY
609
NO CONVERSION
REGISTER NEW ENTRY TO RETRIEVAL MANAGEMENT TABLE
610
END

FIG. 7A

801 SAVING BALANCE TABLE

802 CUSTOMER ID	803 BRANCH	804 SAVING AMOUNT
060001895	SINJUKU	1,050,000
061089288	IKEBUKURO	125,000
060102952	SINJUKU	120,000
----------	-------	-------

FIG. 7B

QUERY Q1 :

```
SELECT CUSTOMER ID, BRANCH, SAVING AMOUNT
    FROM SAVING BALANCE TABLE
    WHERE SAVING AMOUNT >= 1,000,000 ;
```

805

FIG. 7C

QUERY Q2 :

```
SELECT CUSTOMER ID, SAVING AMOUNT
    FROM SAVING BALANCE TABLE
    WHERE SAVING AMOUNT <= 10,000 ;
```

806

FIG. 7D

LINKED QUERY :

```
SELECT CUSTOMER ID, BRANCH, SAVING AMOUNT
    FROM SAVING BALANCE TABLE
    WHERE SAVING AMOUNT >= 1,000,000 OR
    SAVING AMOUNT <= 10,000 ;
```

807

FIG. 7E

DISTRIBUTIVE QUERY DQ1 :

```
SELECT CUSTOMER ID, BRANCH, SAVING AMOUNT
    FROM SAVING BALANCE TABLE
    WHERE ( SAVING AMOUNT >= 1,000,000 OR
    SAVING AMOUNT <= 10,000 )
    AND BRANCH = ' SINJUKU' ;
```

808

FIG. 7F

DISTRIBUTIVE QUERY DQ2 :

```
SELECT CUSTOMER ID, BRANCH, SAVING AMOUNT
    FROM SAVING BALANCE TABLE
    WHERE ( SAVING AMOUNT >= 1,000,000 OR
    SAVING AMOUNT <= 10,000 )
    AND BRANCH <> ' SINJUKU' ;
```

809

"EP0836150A1" 09-04-1998

FIG. 8

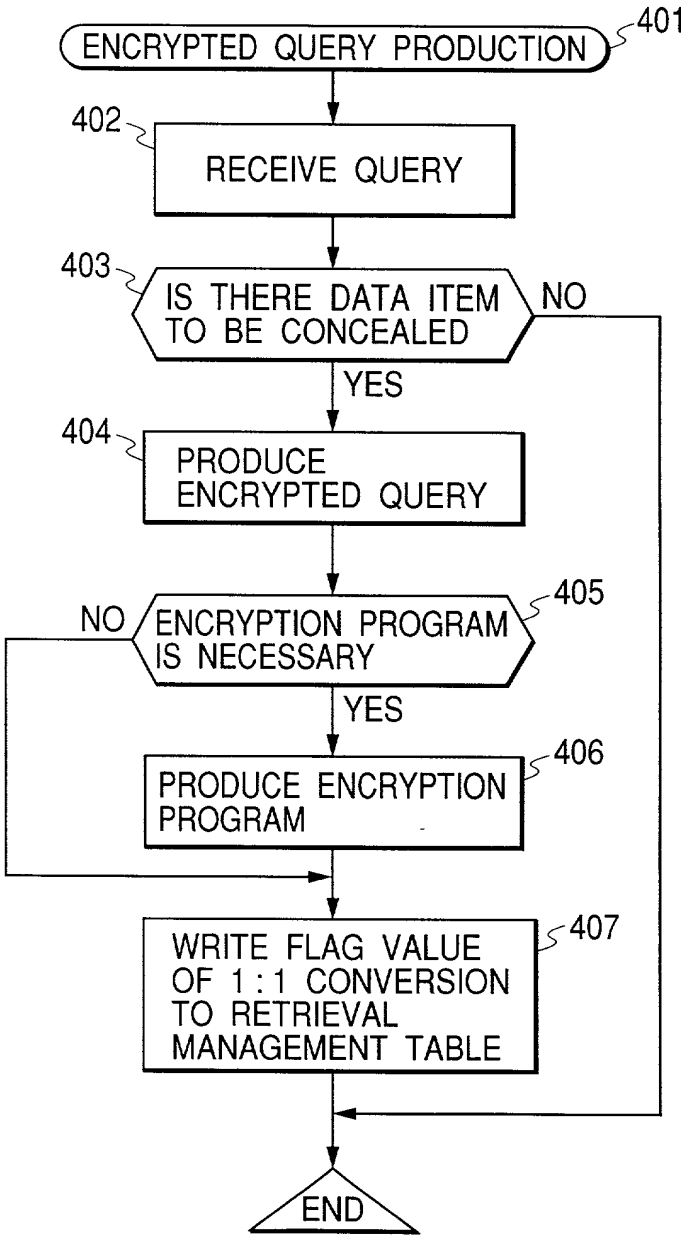

ENCRYPTED QUERY PRODUCTION
401
402
RECEIVE QUERY
403
IS THERE DATA ITEM TO BE CONCEALED
NO
YES
404
PRODUCE ENCRYPTED QUERY
405
NO
ENCRYPTION PROGRAM IS NECESSARY
YES
406
PRODUCE ENCRYPTION PROGRAM
407
WRITE FLAG VALUE OF 1:1 CONVERSION TO RETRIEVAL MANAGEMENT TABLE
END

FIG. 9A

901 GENE ARRANGEMENT TABLE

902 NAME	903 RELATED LINK	904 ARRANGEMENT STRUCTURE
abcd	site A	atcg
efgh	site B	tggctg
ijkl	site C	ccttt
---	---	---

FIG. 9B

QUERY Q3 :

```
SELECT NAME, RELATED LINK
  FROM GENE ARRANGEMENT TABLE
  WHERE ARRANGEMENT STRUCTURE = ' atcg' ;
```

905

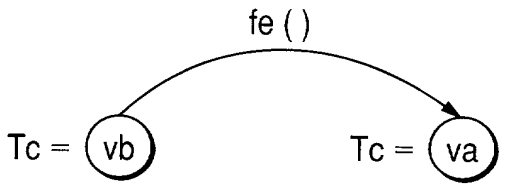
FIG. 9C

QUERY Q4 :

```
SELECT NAME, RELATED LINK, ARRANGEMENT
STRUCTURE
  FROM GENE ARRANGEMENT TABLE
  WHERE ARRANGEMENT STRUCTURE = ' @2aSzE' ;
```

906

FIG. 10



Tc : DATA ITEM TO BE CONCEALED

fe ( ) : ENCRYPTION FUNCTION

vb : ORIGINAL DATA VALUE

va : ENCRYPTED DATA VALUE

FIG. 11

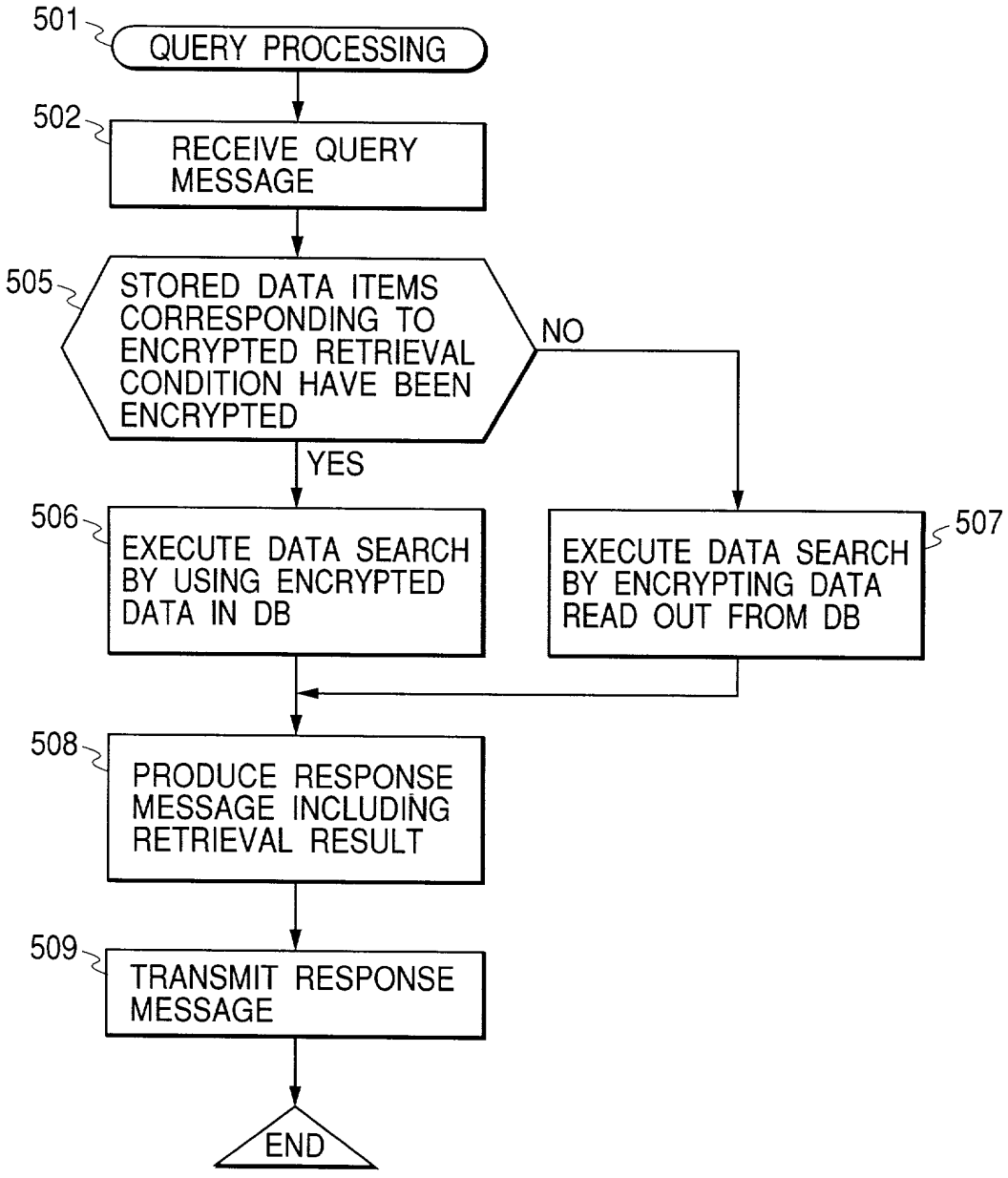
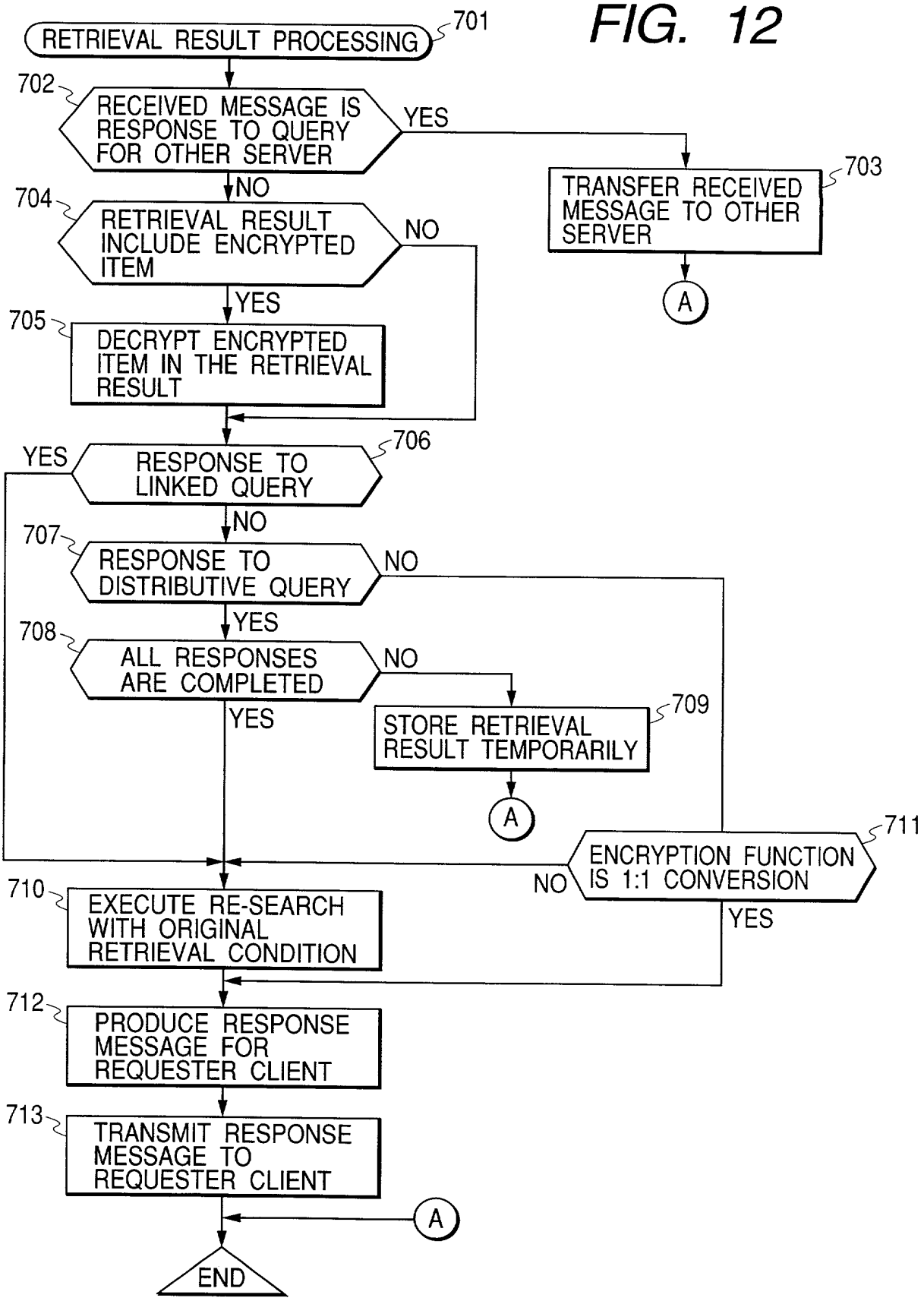

501
QUERY PROCESSING
502
RECEIVE QUERY MESSAGE
505
STORED DATA ITEMS CORRESPONDING TO ENCRYPTED RETRIEVAL CONDITION HAVE BEEN ENCRYPTED
NO
YES
506
EXECUTE DATA SEARCH BY USING ENCRYPTED DATA IN DB
507
EXECUTE DATA SEARCH BY ENCRYPTING DATA READ OUT FROM DB
508
PRODUCE RESPONSE MESSAGE INCLUDING RETRIEVAL RESULT
509
TRANSMIT RESPONSE MESSAGE
END

FIG. 12


RETRIEVAL RESULT PROCESSING
701
702
RECEIVED MESSAGE IS RESPONSE TO QUERY FOR OTHER SERVER
YES
703
TRANSFER RECEIVED MESSAGE TO OTHER SERVER
A
NO
704
RETRIEVAL RESULT INCLUDE ENCRYPTED ITEM
NO
YES
705
DECRYPT ENCRYPTED ITEM IN THE RETRIEVAL RESULT
YES
706
RESPONSE TO LINKED QUERY
NO
707
RESPONSE TO DISTRIBUTIVE QUERY
NO
YES
708
ALL RESPONSES ARE COMPLETED
NO
YES
709
STORE RETRIEVAL RESULT TEMPORARILY
A
711
ENCRYPTION FUNCTION IS 1:1 CONVERSION
NO
YES
710
EXECUTE RE-SEARCH WITH ORIGINAL RETRIEVAL CONDITION
712
PRODUCE RESPONSE MESSAGE FOR REQUESTER CLIENT
713
TRANSMIT RESPONSE MESSAGE TO REQUESTER CLIENT
A
END

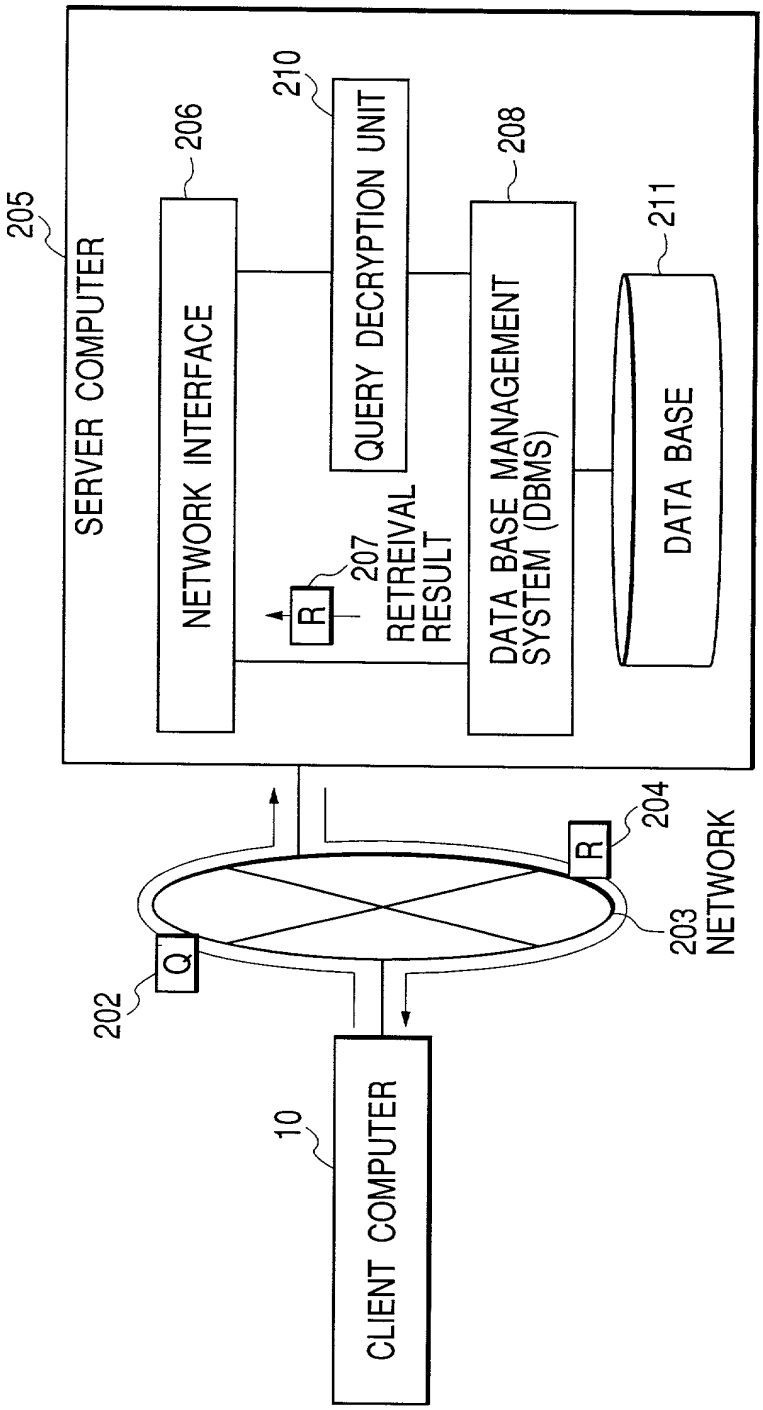



FIG. 13
PRIOR ART